Defence Research and Development Canada
Recherche et développement pour la défense Canada

DEFENCE R&D DÉFENSE

Creating and Sustaining Meta-organizational Memory: a Case Study

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DRDC CSS SL 2008-05

Canada

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
MAR 2009		

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Creating and Sustaining Meta-organizational Memory: a Case Study	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Defence R&D Canada - Ottawa,Centre for Security Science,222 Nepean St 11th fl,Ottawa, ON K1A 0K2, ,**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**		**28**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

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Abstract

Creating and Sustaining Meta-organizational Memory: a Case Study

The case study of the Chemical, Biological, Radiological-Nuclear and Explosives (CBRNE) Research and Technology Initiative (CRTI), a Canadian government meta-organizational collaborative initiative, is presented. Multiple federal departments and agencies have a joint responsibility for creating a knowledge base and a national memory for the purposes of protecting the country against CBRNE threats posed by terrorists. The conditions of a meta-organization present particular opportunities and challenges for organizational learning and organizational memory. Organizational learning and knowledge management theory provide the premises for addressing these issues. An intentional knowledge management strategy has been instrumental in organizational learning, resulting in a knowledge base for a collective organizational memory. Ongoing challenges are being addressed by the strategy.

Créer et maintenir une mémoire méta-organisationnelle : une étude de cas

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On présente l'étude de cas de l'Initiative de recherche et de technologie chimique, biologique, radiologique, nucléaire et sur les explosifs (CBRNE) (IRTC), une initiative de collaboration méta-organisationnelle du gouvernement du Canada. Il incombe à un certain nombre de ministères et d'organismes fédéraux de créer ensemble une base de connaissances et une mémoire nationale en vue de protéger le pays contre les menaces CBRNE que posent les terroristes. Les conditions d'une méta-organisation présentent des possibilités et des défis particuliers pour la mémoire et l'apprentissage organisationnels. L'apprentissage organisationnel et la théorie de gestion du savoir fournissent les prémisses à partir desquelles on peut s'attaquer aux problèmes. La mise en place d'une stratégie de gestion du savoir a facilité l'apprentissage organisationnel, permettant ainsi l'établissement d'une base de connaissances pour la mémoire collective de l'organisation. La stratégie s'attaque aux défis actuels.

Table of contents

Acknowledgements

This document published as chapter XII in :

Giraud, J.P., (2009). Building Organizational Memories . Hershey PA: Information Science Reference

1 Introduction

Consider the dangers and implications of organizational memory loss during a future national security event in which many organizations would have to collaborate to protect the citizens and infrastructure of a country:

After years of international harmony and no overt terrorist activity, a credible and serious threat is received. The national security community goes into high alert and wants expert advice on how to counter and respond to the potential use of weapons of mass destruction. But, after these many years of peace, the research program that had studied these threats has been terminated for lack of perceived threat. The senior scientific experts have retired and the younger scientists have shifted their focus to new domains. The captured knowledge of the program sits somewhere in electronic file cabinets, inaccessible to the remaining subject experts, unknown to new researchers, and in danger of disappearing altogether. Operational planners and responders use their depleted knowledge as best they can to execute their plans. But they are constrained by their limited access to what was once a solid base of expertise, knowledge and understanding of the scientific and technical details of these weapons.

This is a nightmare scenario that would be disastrous and inevitably lead to unnecessary hardship for the citizens and economy of the country. When the critical knowledge was most required, it would be lost in a cloud of national dementia. There would be no time to reacquire the necessary knowledge; it would be needed immediately. Even if it were possible to respond in time, the expense of recreating what was once known would be a waste of the original investment. This deplorable situation, its associated costs and security implications would be disastrous for the country. It is therefore, at the very least, a civil responsibility to ensure that an organizational knowledge and information strategy exists to ensure the long-term access and use of the knowledge created by the original investment.

Although such a scenario of memory loss can be excruciatingly familiar to a single research or response organization, the risk of occurrence increases exponentially when such a research program is shared across organizations. When multiple organizations collaborate in a trust-based relationship to achieve mutual objectives, but without clear ownership of results and outputs, the responsibility for organizational memory is much more tenuous. Meta-organizations, or organizations whose members are other organizations, have additional challenges in ensuring that memory loss does not occur to the detriment of their collective constituents.

The following chapter will present a case study of a Canadian government meta-organizational collaborative initiative. In this case, multiple departments and agencies have a joint responsibility for creating a knowledge base and a national memory for the purposes of protecting the country against the insidious threats posed by terrorist aspirations. It will examine how the conditions of a meta-organization present particular opportunities and challenges for organizational learning and organizational memory. It will describe how a knowledge management strategy has been

instrumental in organizational learning, resulting in a knowledge base for a collective organizational memory. Challenges and potential solutions will be shared as the initiative moves into the future.

The issues to be explored in this case study are:

- Is an organization which is comprised of other organizations able to be successful in organizational learning?
- How can an organizational memory be created to protect Canada from the potential scenario described above?
- What strategies might be engaged to address these issues?

2 Issues, Controversies, Problems

Organization Learning, Memory and Knowledge Management

Organizational memory can only develop from organizational learning. Memory and learning must be inevitably linked. Stein and Zwass (1995, p.95) defined organizational memory as "a means by which knowledge from the past is brought to bear on present activities, thus resulting in increased levels of effectiveness for the organization." Even from their specific information technology viewpoint, Stein and Zwass recognized that memory is much more than a storehouse of information. It is an interaction, a system, a process, or an experience.

If memory is the "capacity to encode, store, and retrieve information" (Gerrig and Zimbardo, 2002), then learning is the process that encodes, stores and retrieves with the end result being a change in behaviour or understanding. For an organization to "learn", it would have to undergo similar processes leading to changed behaviour. Gavin (1998, p. 51.) defined the learning organization as one which is "skilled at creating, acquiring and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights." Therefore, organizational memory is about accessing and recalling what has already been learned, and to use, improve, and expand the organization from this memory. The organizational memory is a product of a learning organization.

In this case study, knowledge management is considered to be the means by which the process of organizational learning is facilitated and organizational memory is created and sustained. The definition of knowledge management used in this study is a "strategic approach to managing the creation, use and exploitation of knowledge for enhanced value and increased innovation," which is notably reflective of Gavin's definition of organizational learning.

The Case

The responsibility for science and technology in the domains of chemical, biological, radiological-nuclear and explosive (CBRNE) counter-terrorism in Canada does not rest with a single organization. Until the end of the Cold War, these threats were entirely within the purview of military research. Only the largest of nations possessed the resources and ability to develop weapons or defence programs to counter these types of agents and threats. With the collapse of the Soviet Union in the 1980's and the emergence of special interest political groups around the world, evidence of rising asymmetric threats began to emerge. In 1995, for example, the religious cult Aum Shinrikyo demonstrated that a small radical group with technical knowledge and financial resources could create havoc when they attacked the Tokyo subway system with Sarin gas. Other signs of this new situation were the disappearance and theft of radiological sources which were frequently reported in the former Soviet Union during the 1990's.

But it was the anthrax and September 11th terrorist attacks in the United States in 2001 that brought the message home to North Americans that the problem could no longer be solely dealt with by military research and responders. Civilian agencies would now have to become involved. The Government of Canada began to explore the means of supporting this type of research and it soon became evident that additional funding for the status quo would only result in exponential

funding increases for on-going programs. It would, however, not provide the benefit of synergies or innovative approaches from inter-organizational collaboration and cooperation. Thus, a unified, national understanding and approach to CBRNE protection of civilian targets was required. There was a need for a "horizontal" approach that could bring the rich pool of existing defence research expertise together with expertise in public health, food and animal protection, domestic radiological knowledge, environmental response, intelligence, law enforcement and other public safety fields. The old wineskin of defence solutions for CBRNE would no longer be the sole paradigm against these new fermenting threats to civilian populations and infrastructures.

The CBRNE Research and Technology Initiative, to be known as CRTI, was the Canadian Government's response to these emerging terrorist threats from weapons of mass destruction.[1] Launched in 2002, the CRTI was a new model for delivering science and technology in Canada, because it turned to federal government science departments, agencies, laboratories and experts to be leaders in the initiative. This was in contrast to traditional Canadian science and technology approach, which is generally led by academia and private industry. At the time, it was recognized that this specialized expertise was firmly resident within the Canadian government and should be leveraged across national sectors. Additionally, the initiative was mandated to engage the innovation system, meaning that participants would have to partner with other departments and agencies and bring together academia and industry into innovative research and development teams. Finally, the investment decisions were to be made on the basis of a consolidated risk assessment, which would be performed jointly by science and intelligence communities.

The CRTI's primary focus has been to strengthen the nation's ability to prevent, prepare for, and respond to CBRNE terrorist attacks. This has been achieved by fostering investments in science and technology that would generate new knowledge and capabilities, as well as harness existing ones. The CRTI has delivered on its mandate through four primary activities:

- by creating Science Clusters, or de facto communities of practice, of federal laboratories as elements of a federal laboratory response network to expand the existing science and technology capacity to address the highest risk terrorist attack scenarios;

- by providing research and development (R&D) project funding to build capability in critical areas;

- by funding projects that accelerate technology into the hands of the first responders, community and other operational authorities; and

- by providing funds for off-the-shelf technology where national capacity is deficient, as a result of obsolete equipment, dated facilities and inadequate scientific teams

The CRTI is comprised of multiple science-based departments and agencies along with national security and central agencies. All of these bodies are represented on a governing Steering Committee and a Program Management Board, and most have membership in five Science Clusters, one for each of the threats, Chemical, Biological, Radiological-Nuclear, and Explosives, as well as an cross-hazard Forensics Cluster.[2] Membership in the CRTI and its Clusters is based

[1] Originally focused on the CBRN threats, the Explosives (E) portfolio was added in 2006.

[2] Initially the CRTI had 13 partner departments and agencies and has grown to include 18 within 5 years: Agriculture and Agri-Food Canada; Canada Border Services Agency; Canadian Food Inspection Agency; Canadian Nuclear Safety Commission; Canadian Security Intelligence Service; Defence R&D Canada; Fisheries and Oceans; Environment Canada; Health Canada; National Research Council Canada; Natural Resources Canada; Public Health Agency of

on how well the respective mandates of the department laboratory or office contribute to or coincide with the mandate of the initiative. In addition to the federal government participants, affiliate membership is available to Provincial or international organizations.

CRTI was initially funded in 2001 with $170 million (Cdn $) for the first five years and was renewed with similar funding for another five years in 2006. Defence R&D Canada's Centre for Security Science manages the program on behalf of the partner departments. Funding decisions for projects are made by the governing bodies on the basis of recommendations from the Clusters and an inter-disciplinary Project Selection Committee.

The CRTI as Meta-Organization

A meta-organization, or an association of organizations, by its very nature is more complex than its individual components. The issues and challenges are observed in large examples such as the United Nations, NATO and the European Union. Meta-organizations can also exist at national, regional and local levels. Ahrne and Brunsson (1995) described how this construct differs from the single organization, i.e., one in which the membership is comprised of individuals. A meta-organization has three main characteristics:

1. Creating and sustaining the meta-organization is dependent on the member organizations' affinity with its purpose and goals and on the value of the corresponding activities and results. Identity and the desire to belong is the glue that draws membership and keeps it intact.
2. Conflict is common because there is more differentiation among organizations than there is among individuals within a single organization. The members of a meta-organization often share similarities which can lead to competition and some members' leaders may have more power and higher status than the leaders of the meta-organization itself.
3. Organizational change is less likely or slower to occur in the meta-organization and, unless it and some of its members become too similar in their goals and approach, it will remain stable. In the short-term, it may be ineffective, but over time the meta-organization usually will make progress and gain importance.

The meta-organization, therefore, offers both challenges and particular strengths for developing organizational learning and memory. The draw to join and participate must be sustained for long-term success. Conflict must be anticipated and mechanisms for its successful management must be established early in its lifecycle. Change can be extremely slow; progress is a long-distance run, not a sprint, and there are usually many hurdles to clear. Yet, unlike a new or evolving individual organization, the meta-organization has immediate access to extensive resources and a capacity for action. And while it may be difficult to resolve conflicts, issuing voluntary standards rather than directives may result in longer-term cooperation.

As an organization that is comprised of other government entities, the CRTI can be considered, at the least, as a variant of a meta-organization. The similarities to Ahrne and Brunsson's three

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Canada; Public Safety Canada; Public Works and Government Services Canada; Royal Canadian Mounted Police; Privy Council Office, Transport Canada, and the Treasury Board of Canada. Additionally the Crown Corporation, Atomic Energy of Canada Limited, has been an active affiliate member.

defining characteristics are evident. First, the impetus for participation in the CRTI was initially two-fold: the global security situation appeared more fragile and the CBRNE threat seemed more immediate than ever before. Partnership in the CRTI was the mechanism to receive funding for research and technology development to counter this threat. Identity with the mandate and the vision of a safer world drew the players into membership. The challenge to maintain this engagement has been more of an obstacle. A perception of a lack of terrorist activity on North American soil can reduce the impetus for some players to continue to participate.

Secondly, like the meta-organization, both disparity and competition between the members has been evident in the CRTI. Within the initiative, there are decidedly non-traditional partners: scientists with intelligence analysts, regulators with licensees, and military with civilian organizations. Concerns about mandate infringement occasionally arise, as well as intermittent resentment about funding decisions when R&D proponents are unsuccessful. Yet, over the years, trusting relationships have been developed and sustained within Clusters and project teams have become increasingly diverse.

Third, the rate of change has been slow and the ability of the CRTI to impact upon the overall national CBRNE emergency preparedness have not been immediate. While the progress in science and technology from the funded R&D projects has been notable, the uptake of the results has not always been as successful. This may be largely as a result of policy issues in Canada as well as standardization gaps and lack of funding sources for operational and front-line responder equipment and training. However, there are signs of long-term, durable progress as a result of the connections made by Clusters and project teams, and the potential for the future is encouraging.

The Learning Organization

Interestingly, the characteristics of the meta-organization correspond with the conditions needed for successful organizational knowledge creation as described by Nonaka and Takeuchi (1995). In their seminal knowledge management book, the authors suggested that individual firms and their work teams can facilitate knowledge generation with the presence of five enabling conditions: intention, requisite variety, fluctuation and creative chaos, autonomy, and redundancy. For the meta-organization each of these apply.

- Clear intent, purpose and goals are required to draw the kind of membership needed in order for the meta-organization to flourish and are also necessary for knowledge creation within the partnership.
- Requisite variety, as provided by membership diversity, will also contribute to the ability to incubate and hatch new ideas.
- While meta-organizations tend to be slow-changing, they do possess sufficient conflict to create the milieu of fluctuation and creative chaos needed for a positive creative tension.
- The autonomy of groups (as opposed to individuals) to work independently within the scope of the organization's intent is another condition for innovation in a learning organization.
- In the meta-organization, autonomy is assured to a large extent because groups operate outside of the confines of a single organization's structure.

CRTI has provided the conditions of intention, requisite variety, fluctuation and creative chaos to the participants of the program. It has also provided the Science Clusters with autonomy to determine their own approaches in filling science gaps and to address their respective threats. When it comes to selecting and funding R&D projects, CRTI has prerequisites for the project teams to provide innovative, albeit relevant, science and technology solutions. Those who have embraced this autonomy have had outstanding results.

The last enabling condition, redundancy, is about good information provision and flow. To be successful, employees or members must have open opportunities to acquire the information that they need. While there may be concerns of information overload or excess waste, the concept of redundancy is that by being exposed to many differing ideas and diverse sources of information, multiple perspectives are available resulting in more creativity. CRTI has attempted to facilitate information dissemination in diverse ways to its participants with a fair amount of success.

Senge (2006) named five disciplines in writing about the factors required for a successful learning organization. According to the author:

- The organization must create and nurture a *shared vision,* or a "permeating commonality," for employees to strive and grow in a mutually beneficial direction.
- *Personal mastery,* or personal growth and learning, is required at the individual level. The organization must facilitate and support the personal quest for continuous learning.
- *Team learning,* through intentional dialogue and thinking together as a group (not to be confused with group think), can move individual learning to a higher plane.
- Questioning *mental models,* those deeply held and sometimes latent assumptions, is required to advance new mental models that will allow institutional changes in creative and expanding ways.
- *Systems thinking,* pulls the first four disciplines together for a successful learning organization. It allows the recognition of how singular events impact the whole system.

Do the five disciplines apply to the meta-organization as seen in the CRTI model? The theme of a "shared vision" appears yet again. It is consistent with members' need for identity within a meta-organization, the ability of an organization to be creative as well as this condition for organizational learning. "Personal mastery" on the individual level does not on the surface apply to the meta-organization. However, in the case of the CRTI, personal mastery has demonstrated itself to be a significant motivator, especially in situations where individuals have taken leadership in transferring their expertise to other participants in the field. "Team learning" is both inherent to, and critical in, the meta-organization. The boundary conditions for learning are possibly more likely in a meta-organizational group than in an individual organizational group because of the diversity of views and knowledge bases. Team learning, particularly in the autonomous CRTI Science Clusters has proven to be a considerable advantage for members and is an incentive for membership itself.

The discipline of "questioning mental models" is likely to exist in the meta-organization. It is most likely to occur because the participating organizations bring with them their own cultures, world views and objectives and will challenge others in the group on their respective assumptions. Success in the CRTI has been demonstrated in cases where mental models were challenged and new approaches pursued. Research on leadership in the CRTI Science Clusters indicated a correlation between levels of participant satisfaction and leaders who were more comfortable with managing complex rather than hierarchical systems and who were comfortable with boundary spanning (MacGillivray, 2006).

The final discipline, “systems thinking,” is fundamental to the success of a meta-organization like the CRTI. By its very nature, a meta-organization is a complex system that must be viewed and approached as such. To assume that simple or linear processes will have direct and “logical” outcomes is folly. These systems require a more considered approach which looks at the underlying structures rather than surface symptoms, (e.g., how would a nation prevent, respond or recover from a CBRNE terrorist attack). In its approach to determining how the program can have a significant impact on national capability in this area, the CRTI has adopted a capability based planning approach which considers the overall system and analyzes where gaps exist and what must be rectified.

From this analysis, it seems that the CRTI is well positioned for organizational learning. The vision is clear, willing and generous experts abound, autonomous team learning occurs, mental models are challenged and the systems approach is being adopted. Is it then able to create and sustain an organizational memory? This is where a knowledge management strategy begins to play its role.

3 Solutions and Recommendations

A Knowledge Management Strategy for the Meta-Organization

The CRTI model for supporting science and technology in the CBRNE area is in itself fundamentally a knowledge management approach. The premises underlying the development of this new program model had their roots in the knowledge management and innovation theories of the 1990's. During that time period, business, academia and government communities everywhere were looking for innovation strategies and recognized opportunities by engaging in collaboration and cross-sector cooperation. The basic notion was that a knowledge base could be developed by engaging all components of the innovation system in Canada, which Freeman (1987) had first described as "…the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies."

The untapped potential of the innovation system became a policy driver in the late 1990s. The Canadian government of the time released its *Canadian Innovation Agenda for the Twenty-First Century* in June 2001, which called for "more coordination of intramural science and technology activities among federal agencies, as well as greater collaboration on major horizontal issues – those that cut across departmental and agency boundaries" as a strategy for Canada to become more competitive in the global economy. The government encouraged alternate service delivery models, including horizontal initiatives, in which partners from two or more governmental entities establish a formal funding agreement to work toward the achievement of shared outcomes.

The emphasis on innovation was one of the premises in the knowledge management literature of the time. Davenport and Prusak (1998) talked about the need to "emphasize the creative potential inherent in the complexity and diversity of ideas …" An awareness of the role of interdisciplinary dialogue in innovation and process improvement was of great interest in business and research communities. This type of cooperation was seen as a means of leveraging limited resources while discovering new knowledge or products. Knowledge was perceived as the unique resource that gave an organization a strategic advantage over competitors (for human resources, market share or other targets) and knowledge management was the passkey. Employing knowledge management would give an organization the "knowledge advantage" by aiding decision making, speeding innovation, reducing time to competency, reusing knowledge that was expensive to create and expanding networks through interoperability, as well as provide other benefits.

The federal science and technology community knew that if the model worked according to these knowledge management premises, there would be vast quantities of new knowledge shared and generated. The model was developed to include knowledge management from the beginning. There were two areas to be considered:

1. Scientific knowledge management was required to enable effective interactions between participants to stimulate science and technology for innovation and knowledge creation; and

2. Programmatic knowledge managed with tools, methods and approaches for the communication, exchange and dissemination of information about the program and it business processes.

What was not so obvious to the prospective participants was how this new model would actually engage and manage what was to be created. Shortly after the CRTI was launched, stakeholders from the new Science Clusters were gathered to discuss how they wanted knowledge management to operate and what they expected out of it. It became immediately obvious that a diverse approach would be required to create, share and disseminate the existing knowledge resident in the participants and the developing knowledge of the CRTI program. A strategy was required to achieve the organization's knowledge objectives.

The Knowledge Management Strategy was developed to facilitate the realization of this intent through a relevant theoretical basis and planned activities. The purpose was to stimulate science and technology innovation and knowledge creation among participants and stakeholders, to capture and record new knowledge and to disseminate CBRNE knowledge to the broader community for increased capability and Canadian resiliency.
Based on an understanding of knowledge management theoretical assumptions and the kind of approach that the stakeholders required, 11 principles for CRTI knowledge management were outlined:

1. Knowledge management is a strategic tool for achieving outcomes, but only when it is robustly applied.

2. A knowledge management program must facilitate the creation, exchange and use of both explicit and tacit knowledge by all stakeholders.

3. Codified knowledge is only a small portion of the total existing knowledge in the CBRNE domain and it should be captured and disseminated in the most focused and usable manner.

4. A successful knowledge management strategy and program requires clear and shared intent among all stakeholders. This is particularly vital in a complex environment where there are multiple participants with diverse mandates, operational cultures and knowledge. This supports the development of the trust required to prepare and respond effectively.

5. Communicating intent among participants requires knowledge management tools and activities that can disseminate communications in various media on interoperable platforms and that will facilitate shared experience.

6. A robust knowledge management program must employ all aspects of the knowledge cycle: creation, capture, use of knowledge.

7. A robust knowledge management program in the CBRNE domain must recognize its context of complexity and systems thinking.

8. Learning activities, particularly in group, organizational and inter-organizational situations, should be a focus of the program in order to ensure long-term organizational memory for local and national preparedness.

9 Knowledge management should nurture leadership for communicating intent and achieving operationally relevant results.

10. The knowledge management program should be based on a balanced approach which incorporates:

- a culture of knowledge creation and sharing;
- technology that supports the knowledge management goals and program outcomes;
- leadership development and support;
- knowledge conversion processes; and
- a measurement approach to determine if knowledge management activities are contributing to outcomes.

11. Significant security challenges in knowledge gathering and exchange within a non-homogenous community must be addressed. The program must manage the paradox of how the more valuable knowledge in the counter-terrorism science domain becomes, the more sensitive it can be and thus, the more restricted is its access.

The CRTI's Knowledge Management Strategy was built upon holistic knowledge management theory and premises that focus on recognizing and managing the respective roles of tacit and explicit knowledge in organizational learning and innovation. It recognized the importance of the knowledge management cycle and the necessity of a balanced approach to all aspects of creation, capture and sharing of knowledge.

A Knowledge Management Model for the CRTI

A good knowledge management model is a tool that provides a balanced checklist of the components to ensure that the strategy and program will be effective. Girard (2004) examined a number of knowledge management models in the literature and found five commonalities: leadership, culture, technology, process and measurement, with the first three being foundational. He coined it the "Inukshuk", after the Inuit navigational marker. This marker took an anthropomorphized form and therefore embodied the fundamental element of the human being in knowledge management. CRTI's approach follows this model.

Leadership

Bennis (1999) wrote that there are four primary attributes of a successful leader. First, an effective leader provides a *sense of purpose* to those he or she leads; this is most often accomplished by bringing passion, perspective and significance to the organizational intention. Second, leaders generate and sustain *trust* by creating a climate of candor. Third, leaders *foster hope and optimism*. Fourth, they are *results-oriented*, often taking risks or creative approaches to attain results.

Without disputing what seem like obvious leadership attributes, the CRTI sponsored a study to look at the relationship between leadership, knowledge management and complexity within its own model. MacGillivray's study (2006) found that leading knowledge management in complex

environments likely requires leadership skills that vary from what is normally required in a hierarchical environment. She stated,

There are strong relationships amongst a complexity-orientation, efforts to encourage the flow of knowledge, and perceived satisfaction and effectiveness…Differences in perspectives between formal leaders and participants of a cluster do not appear to be problematic if the cluster leader is treating the environment as complex, where diversity and interaction are valued over consensus and alignment.

The work, while not conclusive, does suggest the need for alternative or additional leadership skills in such a complex environment.

Culture

By now, it is almost trite to express the importance of fostering a knowledge-friendly culture in order for the learning organization to exist or for it to induce innovation. Much has been written on the components required for knowledge management, learning or innovation to occur, Nonaka and Senge being but two examples. When the knowledge sharing milieu isn't present, change management can be employed from above or below to encourage these changes, but creating that culture can be challenging and even forbidding. Rewards and incentives to build interpersonal trust, organizational support for initiatives, leadership development and rewards for sharing are some of the approaches used to encourage the culture to grow when it is not inherent.

Parker and Selsky (2004) explained how organizational cooperation in cause-based relationships can benefit when they develop an "interculture" at the boundary between participating organizations. When diverse organizations work together for mutual benefit, the most success is derived when they create a new form of culture without adopting either a dominate organization's culture or maintain the parent cultures in their interactions. An emergent culture provides rich opportunities for learning, which in turn benefits the diverse parent organizations. Rao (1996) said that this type of cooperation created a meta-culture.

In a similar way, the CRTI, as a new entity, was given the privilege of starting off with a clean slate. There was no existing culture to manage and creating the conditions for a knowledge rich environment was a real possibility and an established goal from the beginning. As Parker and Selsky describe, only after creation does the new construct begin to take shape as the participants negotiate the desired attributes of the relationship. They call the process whereby boundary spanners negotiate that cultural interface into a distinctive space as "reculturation." Indeed, the CRTI partners have had to develop the mutual trusts of competence, goodwill and power as they pertain to the new inter-culture that has become CRTI.

Technology

Knowledge management information technology (IT) is a large and constantly evolving field. Many promising systems are appearing and there is reason to hope that future IT will successfully facilitate knowledge management activities. The vast amount of information that has been or is

now being created demands that sophisticated systems for capture, search, retrieval and analysis be employed. Many failed knowledge management IT projects to date have proven that technology in itself will not provide the solutions for knowledge sharing and organizational learning and memory.

The CRTI, in employing a knowledge portal as a platform for knowledge sharing, discovered that even with dedicated staff to train users, populate the site and act as facilitators, participation by the community was not assured. The typical user did not have the time or inclination to contribute. Technical and security requirements to ensure a trusted environment worked against the type of accessibility that users expected. Additionally, technology moves quickly, often out-dating state-of-the-art systems even before deployment.

Process

In the Inukshuk Model, the Nonaka and Takeuchi (1995) Socialization-Externalization-Combination-Internalization (SECI) model is used to describe the knowledge management process. The SECI model provided a useful framework for ensuring that CRTI knowledge creation would be balanced. The model indicates that knowledge management must facilitate knowledge sharing, conversion, capture and use by creating opportunities in four classes of knowledge conversion:

- Socialization (tacit-tacit exchange or shared experience);
- Externalization (tacit-explicit conversion or knowledge capture);
- Combination (explicit-explicit capture or codification); and
- Internalization (explicit-tacit adoption or learning).

Holistic in approach, CRTI knowledge management processes have taken the SECI model as its guidepost.

The first priority of CRTI was to build an environment in which organizational and individual learning, or knowledge generation, sharing and capture could occur. Recognizing the importance of active learning and trust building in the ***socialization*** conversion sphere (tacit-tacit), the main CRTI knowledge management activities focused on Cluster activities. These activities included workshops to exchange information about existing programs, table-top and field exercises to learn new knowledge and skills and first responder workshops to allow scientists and operational people to meet and learn about each others' expertise.

It was further recognized that, where possible, the tacit knowledge should be captured for dissemination and long-term benefit, i.e., ***externalization*** conversion. The After-Action Review was incorporated into activities and training on how to effectively conduct the process was provided. Reports were required with actionable recommendations after events, exercises and workshops. An annual symposium was instituted in which new developments and progress was reported to the broad community, with a focus on the relevance of the work to the operational community. Technology demonstrations were used to share and elicit feedback on the utility of new developments.

Perhaps the least complicated, but most labour intensive knowledge conversion process in the SECI model is that of ***combination***, in which existing explicit knowledge is re-analyzed or re-packaged for broader dissemination. Here the CRTI was able to move quickly. A knowledge portal was implemented by which members of the broad CBRNE community could share a community space, find and deposit documents and information, and exchange information in a secure and trusted space. Documents which were community specific could be stored on the site for access by the community. Information which could be shared publicly, whether about the results of the program, events, or how to become involved in the CBRNE community, became the focus of a broader communications approach using the external website and communications products, such as success stories, annual reports and media releases. Another ***combination*** example is the compilation of a bibliography of formal publications arising from the research and development projects. Finally, the Clusters took the results of their lessons learned and created new protocols, technical response plans and concept of operations for future use.

The SECI model's fourth quadrant, the ***internalization*** knowledge conversion process in the cycle, is fundamental to organizational learning. That which has been made explicit, such as lessons learned or a concept of operations, is tested and tried again, resulting in an expanding knowledge base for both the participants and the organization. This is most successful in shared experiences, such as in exercises, particularly full-scale field exercises, training events or trials of new equipment or protocols. When these experiences occur, the cycle begins again and trust building is accomplished with socialization during the events.

Measurement

Measuring is fundamental to the ability to manage. In the realm of knowledge management, it can be difficult to determine what actually can and should be captured. A knowledge management system is as unique as its respective organization and so too are the goals of the metrics process for each individual knowledge management system. Yet, the efficacy of a knowledge management approach and its impact on the goals and outcomes must be measured to justify its use and to adjust for continuous improvement. Dalkir et al. (2007) performed a literature review of existing measurement and evaluation systems for intellectual capital and recommended the adaptation of a results-based management approach used for outcome evaluation. In using this approach, the CRTI has been able to determine which of its knowledge management activities are meeting the needs of the constituency and which need improvement. Without this feedback mechanism, the impact would not be known.

Implementing a knowledge management model in the meta-organization requires intentional facilitation and leadership. Knowledge management, as in any other type of management initiative does not "just happen"; there must be a catalyst for its incorporation into the structure. In the meta-organization, this is provided by a neutral or impartial broker (Chouinard, 2008), someone or some body that is seen as unbiased. The broker facilitates the adoption of knowledge management processes as agreed upon by the members. For the CRTI, a Secretariat was created which would undertake the management and facilitation of the common goals of the Initiative. It was able to take the initial steps that led others to adopt knowledge management processes.

4 Opportunities and Challenges for Sustaining CRTI Organizational Memory

In its first five years, the CRTI has demonstrated progress in its ability to facilitate organizational learning. How then is the CRTI positioned to sustain the organizational memories it has begun to generate? A SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis provides an assessment of knowledge management in this meta-organization.

Strengths

CRTI has focused on building community relationships and on producing quality results and outputs that will support the overall long-term outcomes. By focusing on opportunities for disparate participants to connect and share knowledge (e.g., symposia, workshops, exercises), new diverse relationships have been forged resulting in partnerships and joint research projects. This outreach has included stakeholders from beyond science and technology to policy, operations, academic, industrial and international communities. Further, the governance framework and Science Clusters incorporate respected leaders from federal science-based departments and agencies, enhancing the CRTI's credibility. By building a strong social network with organizational and interpersonal linkages, learning and memory should become more embedded over the long-term.

The focus on results-oriented research and development projects, which respond to identified risks and gaps, has led to a well established reputation for success in the advancement of science and technology knowledge in the CBRNE community. The science-based and operations research approach to technology forecasting, risk assessment, capability based planning and priority setting has given the program a reputation for rigor. Successes, particularly those of communities, have been regularly communicated to the stakeholders to encourage continuing engagement and identity with the CRTI. A reputation for quality and success will hopefully lead to ongoing commitment and support for continued funding and participation.

Challenges

A meta-organization, as noted, involves multiple (sub) cultures operating in different fashions, often holding opposing premises and using different vocabularies. In extreme instances, participating organizations may guard their own mandates closely and prefer not to cooperate on common issues. Organizational flux in member organizations can be a real barrier in sustaining the organizational memory. Engagement, while a strength when it exists, is a challenge for new players who are unfamiliar with the domain. Although organizational commitment to participate in the CRTI might be formalized, there is a constant need to educate new senior decision makers as they replace former representatives and to solicit their support for the employees in their respective organizations who are pursuing CBRNE science and technology activities.

Additionally, Cluster members already have primary mandated responsibilities within their home organizations and, although they may have support to pursue CRTI activities, including knowledge sharing, these CRTI tasks often represents a supplementary workload.

Opportunities

Opportunities to pursue knowledge management and organizational learning continue to arise for the CRTI. As its reputation and influence grows, new relationships with operational communities and training organizations are initiated. Where a mutual wariness once existed, first responders and other operational communities are increasingly willing and interested in developing relationships with the science and technology community and vice versa. Many potential stakeholders in the public safety and national security communities have expressed interest in further cooperation and discussions. The lessons from the first years of the program are now available to be shared in a broader context. A hunger for the knowledge that has grown in the past five years is evident in the broader community and signifies an opportunity for sustained support of the CBRNE knowledge base. It also suggests an opportunity for evolving Government of Canada contributions to improve preparedness through rigorous approaches to organizational learning across sectors through the meta-organization.

Threats

Ironically, the most significant threat to CRTI's ability to successfully maintain an organization memory is the perception that a CBRNE terrorist threat is not imminent. While none of the participants would ever wish for an attack of any form, they do believe that they must prepare for what they hope will never happen. The instability in much of the world does not indicate that the international threat will soon disappear, but a peaceful existence on North American soil could remove any impetus for the need to maintain a CBRNE knowledge sharing culture and memory.

The Future: Securing an Organizational Memory

Dalkir (2005) described a knowledge management cycle which is a particularly useful framework when considering how organizational learning can convert into organizational memory for long-term application. Beginning with knowledge creation and capture, the cycle moves to sharing and dissemination, and finally to acquisition and application. Between each of the three stages, intellectual effort is required to render the knowledge useable in the next stage. For example, once created and acquired, knowledge must be assessed to make it useful. Likewise, once shared or disseminated, it must be contextualized to give it value for the users who will acquire and apply the knowledge. Finally, knowledge must be continually updated to be relevant. Using this knowledge cycle, it can be seen how the CRTI might do more to sustain the organizational memory.

Creation and Capture

A fundamental component of creating knowledge for the CRTI is the aspect of identifying lessons learned and how they can contribute to organizational learning. How this concept is best understood is through the military example. The learning cycle begins with experience, often acquired in theatre or the field. After-action-reviews are conducted and lessons-learned from the experiences are captured and converted into doctrine (i.e., policies or principles accepted as valid). Training programs are developed from the doctrine, exercised and subsequently subjected to the lessons-learned process again before influencing new doctrine in a continuing cycle. The After Action Review Cycle™ has been designed by Darling and others (2005) for experiential and immediate learning in both field and more traditional exercises.

The challenge for CRTI is to go beyond identifying lessons to actual learning lessons, particularly in an environment in which it has no authority or responsibility for developing the resulting policies or doctrine. A means must be found in which lessons learned and the resulting required changes are recommended for doctrinal and procedural changes in federal, provincial and municipal governments and operational organizations across the country.

Capturing knowledge, not with the sole purpose of archiving that which was learned but to anticipate future access and retrieval, requires an upgrade to the design and implementation of a robust electronic content management system. Usability of a knowledge management system for storing organizational memory will require a solid metadata standard, a subject taxonomy that aids search, retrieval of CBRNE information, and policies for usage, security and migration for upgrades or in the event of program termination.

Sharing and Dissemination

Although the CRTI has been quite successful in sharing and disseminating its knowledge, further efforts would benefit the organizational memory of the CBRNE community: expertise location and training partnerships. The ability of the CRTI to build and maintain a registry of experts in the CBRNE domain has been problematic and unsuccessful to date. The reasons for this are due both to meta-organizational issues as much as to the culture of science; from concern about circumventing government emergency protocols to concerns about potential litigation to the sincere humility of scientists who do not want to claim expertise. An up-to-date locator system would be very important to the community should an event be anticipated or occur. It could be used to receive quick advice and guidance to supplement existing protocols and procedures. It could also be used to alert the community and solicit input for both routine and emergency information.

Another mechanism for building organizational memory is through the dissemination of CBRNE science and technology knowledge to operational and policy communities through continuing education and training. By partnering with the organizations that provide training to Canada's CBRNE responders, such as the Canadian Emergency Management College and others, new and state-of-the-art knowledge could be integrated into training, reaching operational communities across the country and ensuring a harmonization of the national knowledge base.

Acquisition and Application

The CRTI is in a good position to facilitate the acquisition of knowledge by converting lessons learned and new knowledge into usable materials. The results of some of the research projects are now sufficiently mature to begin being compiled into guidelines for first responders, handbooks, or training materials and to replace aging and out-of-date materials. The long-term strategy for this approach might be to partner with a publisher who would be in a good position to create new editions as the knowledge grew and changed.

5 Conclusion

The initial mandated goals of the CRTI have been realized: a knowledge-based risk and investment approach; Science Clusters which have served as successful communities of practice; collaborative funding decisions to enhance government laboratories and; over 150 research and development projects, many making significant contributions to the Canadian economy and the national CBRNE knowledge base.

The CRTI knowledge management strategic approach to organizational learning and memory was a factor in the attainment of these goals. By employing intentional strategies, the CRTI as a meta-organization has successfully facilitated organizational learning. Some of the lessons in achieving this have been to:

- Devise and employ a robust, balanced knowledge management strategy and framework which addresses the complexity of meta-organizations.
- Create all of the conditions of a learning organization and look to impartial brokers to initiate the lead.
- Use intentional, cross-domain knowledge sharing experiences to build trust, create knowledge and build diverse communities.
- Communicate successes to build community satisfaction and the desire for more success.
- In a meta-organization, cultural shifts are ongoing and require continuous learning by new participants and decision-makers.

This case study has tried to demonstrate that as an example of a meta-organization, CRTI as been able to show significant success in facilitating organizational learning. Progress in developing organizational memory has also advanced greatly. But, creating a sustainable organizational memory to protect Canada from potential CBRNE requires more work. Knowledge management techniques and tools (e.g., integrated training, electronic knowledge management systems, locators, repositories and lessons learned systems) must be continually upgraded and adapted.

The real proof of success will be in the realization of this scenario:

After years of international harmony and no overt terrorist activity, a credible and serious threat is received; the national security community goes into high alert and looks for expert advice on how to counter and respond to the potential use of weapons of mass destruction. Although the research program no longer receives major funding, the core of the program is sustained by a small group dedicated to countering CBRNE threats to national security with support from Science Clusters. Operations staff and responders are confident in their preparedness knowing that their training, protocols and standards are up-to-date through continuous improvement and training. They have incorporated recommendations from lessons learned into plans and procedures. If unsure of details, they can consult the on-line CBRNE knowledge base to search for more information or find answers to specific questions. When they encounter something which seems to be new, they search for an expert and query them. Operational planners and responders are confident that the knowledge they access is authoritative and that they can rely on a backup community of expertise, knowledge and understanding of the science and technology details of these weapons to support them.

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DOCUMENT CONTROL DATA

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATOR (The name and address of the organization preparing the document. Organizations for whom the document was prepared, e.g. Centre sponsoring a contractor's report, or tasking agency, are entered in section 8.)

DRDC Centre for Security Science
222 Nepean St 11th fl
Ottawa, ON K1A OK2

2. SECURITY CLASSIFICATION (Overall security classification of the document including special warning terms if applicable.)

UNCLASSIFIED

3. TITLE (The complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title.)

Creating and Sustaining Meta-organizational Memory: a Case Study

4. AUTHORS (last name, followed by initials – ranks, titles, etc. not to be used)

McIntyre, S.G.

5. DATE OF PUBLICATION (Month and year of publication of document.)	6a. NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.)	6b. NO. OF REFS (Total cited in document.)
March 2009	26	18

7. DESCRIPTIVE NOTES (The category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

Open Scientific Literature

8. SPONSORING ACTIVITY (The name of the department project office or laboratory sponsoring the research and development – include address.)

9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)	9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.)

10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document.)	10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.)
DRDC CSS SL 2008-05	

11. DOCUMENT AVAILABILITY (Any limitations on further dissemination of the document, other than those imposed by security classification.)

Unclassified/Unlimited

12. DOCUMENT ANNOUNCEMENT (Any limitation to the bibliographic announcement of this document. This will normally correspond to the Document Availability (11). However, where further distribution (beyond the audience specified in (11) is possible, a wider announcement audience may be selected.))

Unlimited

13. ABSTRACT

The case study of the Chemical, Biological, Radiological-Nuclear and Explosives (CBRNE) Research and Technology Initiative (CRTI), a Canadian government meta-organizational collaborative initiative, is presented. Multiple federal departments and agencies have a joint responsibility for creating a knowledge base and a national memory for the purposes of protecting the country against CBRNE threats posed by terrorists. The conditions of a meta-organization present particular opportunities and challenges for organizational learning and organizational memory. Organizational learning and knowledge management theory provide the premises for addressing these issues. An intentional knowledge management strategy has been instrumental in organizational learning, resulting in a knowledge base for a collective organizational memory. Ongoing challenges are being addressed by the strategy.

On présente l'étude de cas de l'Initiative de recherche et de technologie chimique, biologique, radiologique, nucléaire et sur les explosifs (CBRNE) (IRTC), une initiative de collaboration méta-organisationnelle du gouvernement du Canada. Il incombe à un certain nombre de ministères et d'organismes fédéraux de créer ensemble une base de connaissances et une mémoire nationale en vue de protéger le pays contre les menaces CBRNE que posent les terroristes. Les conditions d'une méta-organisation présentent des possibilités et des défis particuliers pour la mémoire et l'apprentissage organisationnels. L'apprentissage organisationnel et la théorie de gestion du savoir fournissent les prémisses à partir desquelles on peut s'attaquer aux problèmes. La mise en place d'une stratégie de gestion du savoir a facilité l'apprentissage organisationnel, permettant ainsi l'établissement d'une base de connaissances pour la mémoire collective de l'organisation. La stratégie s'attaque aux défis actuels.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS

Organizational learning; Knowledge management strategies; Meta-organizations; Counter-terrorism science and technology; CBRNE